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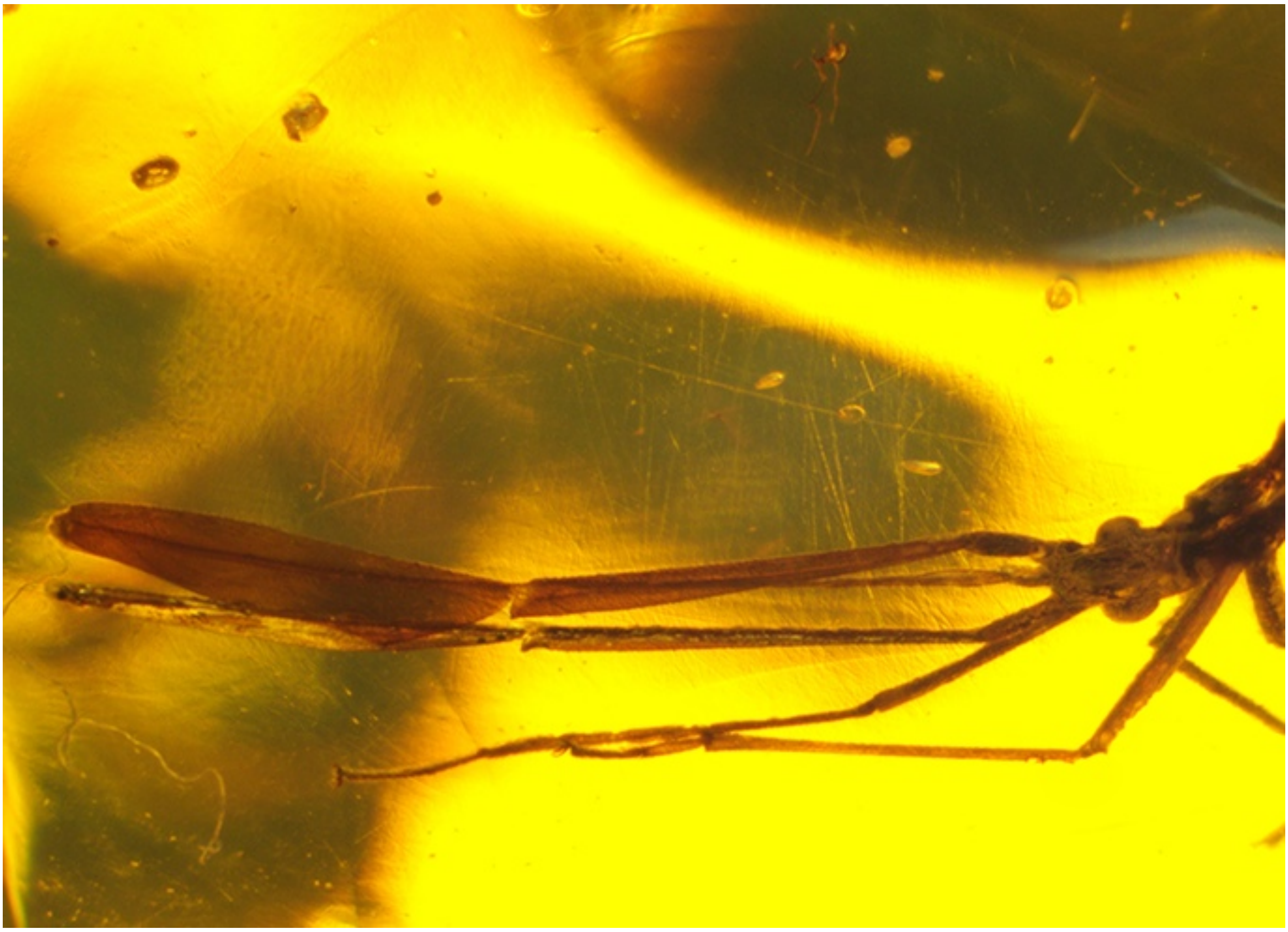

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An additional Cretaceous *Ferriantenna* Cumming & Le Tirant, 2021 species with wildly exaggerated antennae (Hemiptera, Coreidae)

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Hemiptera;
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paleoentomology;
taxonomy;
description;
new species;
Myanmar;
amber.

Abstract. – An additional species of exaggerated antennae Coreidae is described from Myanmar amber of the Late Cretaceous (Cenomanian stage). *Ferriantenna gracenuoxichenae* **sp**. **nov**. can be differentiated from other presently known congenerics by the species-specific antennae. In *Ferriantenna gracenuoxichenae* **sp**. **nov**. the antennae are notably longer than the body where other known species have antennae which are approximately the same length. Additionally, in *Ferriantenna gracenuoxichenae* **sp**. **nov**. antennomeres II and III differ significantly in their morphology but in other known *Ferriantenna* species antennomeres II and III are similar in form and only differ slightly in size. The herein described species, like congeners from the same deposit, is unfortunately also a nymph and is missing the apex of the abdomen. Therefore, this additional species fails to yield additional morphological characters for more confident placement within the coreids.

Cumming R.T., Le Tirant S. & Chen H., 2024. – An additional Cretaceous *Ferriantenna* Cumming & Le Tirant, 2021 species with wildly exaggerated antennae (Hemiptera, Coreidae). *Faunitaxys*, 12(5): 1 – 6.

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Introduction

Coreidae (“coreids”; leaf-footed bugs) have a cosmopolitan distribution and at present approximately 3,100 described extant species are known (Henry, 2017). Many extant coreids are characterized by having expansions or ornamentation on their hind femora/tibiae (Dolling, 2006). These hind leg adaptations have been identified as being used within various intraspecific competition/displays and loss of these limbs (often through predation or poor molting; Maginnis, 2008) has been observed to negatively impact reproductive fitness (Eberhard, 1998; Procter et al., 2012; Emberts et al., 2016).

Unfortunately, as coreids are relatively large insects (as far as fossil preservation is concerned), their fossil record is notably fragmented, often with only nymphs or fragmentary specimens collected. Additionally, Cretaceous coreid fossils are uncommon, with only a few species having been found in amber inclusions and several impression fossils presently known (Du et al., 2021). With the Cretaceous deposits of Burmese amber well-known for their plethora of noteworthy insect inclusions (Grimaldi et al., 2002), it is no surprise that these deposits have continued to yield outstanding coreid species, with never before seen morphology.

Materials and Method

The amber containing the holotype specimen originated from the Hukawng Valley in northern Myanmar, a site of extensive amber excavation which has yielded a great many inclusion fossils (Grimaldi et al., 2002). The age of this deposit is estimated to be ~98.79 ± 0.62 million years old, within the Cenomanian stage of the Cretaceous (Shi et al. 2012). The holotype specimen described herein was morphologically reviewed using a 2x-225x trinocular boom stand stereo microscope (#ZM-4TW3-FOR-20MBI3) and photographs were taken with the attached high-speed 20MP camera (#MU2003-BI-CK) (AmScope, Irvine, USA). Illumination was from a 6-Watt LED dual gooseneck illuminator lit by an #85-265VAC/50-60Hz lighting unit (AmScope, Irvine, USA). Measurements were taken using AmLite digital camera software for Mac OS X 10.8 64-bit which was calibrated with a microscope stage calibration slide (#MR095), 0.01mm div. (AmScope, Irvine, USA). Adobe Photoshop Elements 13 (Adobe Inc., San Jose, USA) was used as post-processing software. Illustrations were done by scientific illustrator Liz Sisk (Washington D.C., USA) using either photographs of holotypes or photographs saved from various online sources illustrating non-type specimens. The holotype specimen is deposited within the Montreal Insectarium, Montreal, Quebec, Canada (IMQC).

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Systematic paleontology

Class **Insecta** Linnaeus, 1758
Order **Hemiptera** Linnaeus, 1758
Family **Coreidae** Leach, 1815
Subfamily **Coreinae** Leach, 1815
Genus ***Ferriantenna*** Cumming & Le Tirant, 2021
http://zoobank.org/40E251C3-987F-4F74-A89B-6545E487EDC8

Type species. – *Ferriantenna excalibur* Cumming and Le Tirant, 2021.
http://zoobank.org:act:6D28929A-DF04-4038-BB44-B23DAE46BB82

Taxonomic remarks. – The herein described species fails to yield additional clues for the taxonomic placement of *Ferriantenna* within the greater Coreidae. Just like other recovered congeneric inclusions, this species is also a nymph and is missing the tip of the abdomen (therefore, diagnostic features such as wing venation, genitalia, and knowing whether or not the adults have/do not have ocelli, are lacking).

Differentiation. – Within Cumming and Le Tirant (2021) the genus *Ferriantenna* was erected for several Cretaceous coreids which differed notably from the only other known Cretaceous coreid with elaborate antennae morphology, *Magnusantenna* Du & Chen, 2021. Several features were noted to allow differentiation between these genera (length ratio of antennomeres, leg length and thickness, head width, and thorax/abdomen general morphology; Cumming & Le Tirant (2021)). The herein described species is tentatively placed within the genus *Ferriantenna* due to having similar compound eye, head, and thorax morphology to the other *Ferriantenna* species. Interestingly though, this new species also has a few features which are found within *Magnusantenna*. First, long, thin legs are present in both *Magnusantenna* and *Ferriantenna gracenuoxichenae* **sp**. **nov**., likely these are required to compensate for their exceptionally long antennae (in both cases longer than their bodies; Fig. 1C and D), versus other *Ferriantenna* species which have shorter antennae (with legs that are not quite as long; Fig. 1A and B). An additional feature which likens our herein described species is the varying morphology between antennomeres II and III (with II relatively simple and III notably different with lobes; Fig. 1C and D). Within the other known *Ferriantenna* however antennomeres II and III have very similar morphology (Fig. 1A and B).

As it appears the coreids of the Cretaceous often had elaborate and quite variable antennae morphology, we feel this feature is more plastic/species specific, whereas similar general body plans may indicate more closely shared ancestry more reliably. Following this line of reasoning the herein described species is placed within *Ferriantenna*, which can be differentiated from *Magnusantenna* by larger compound eyes relative to the head size, a head that is narrower than the thorax, and a thorax with undulating widths. Whereas *Magnusantenna* has smaller compound eyes, a head that is the same width as the thorax, and a thorax with straight lateral magins.

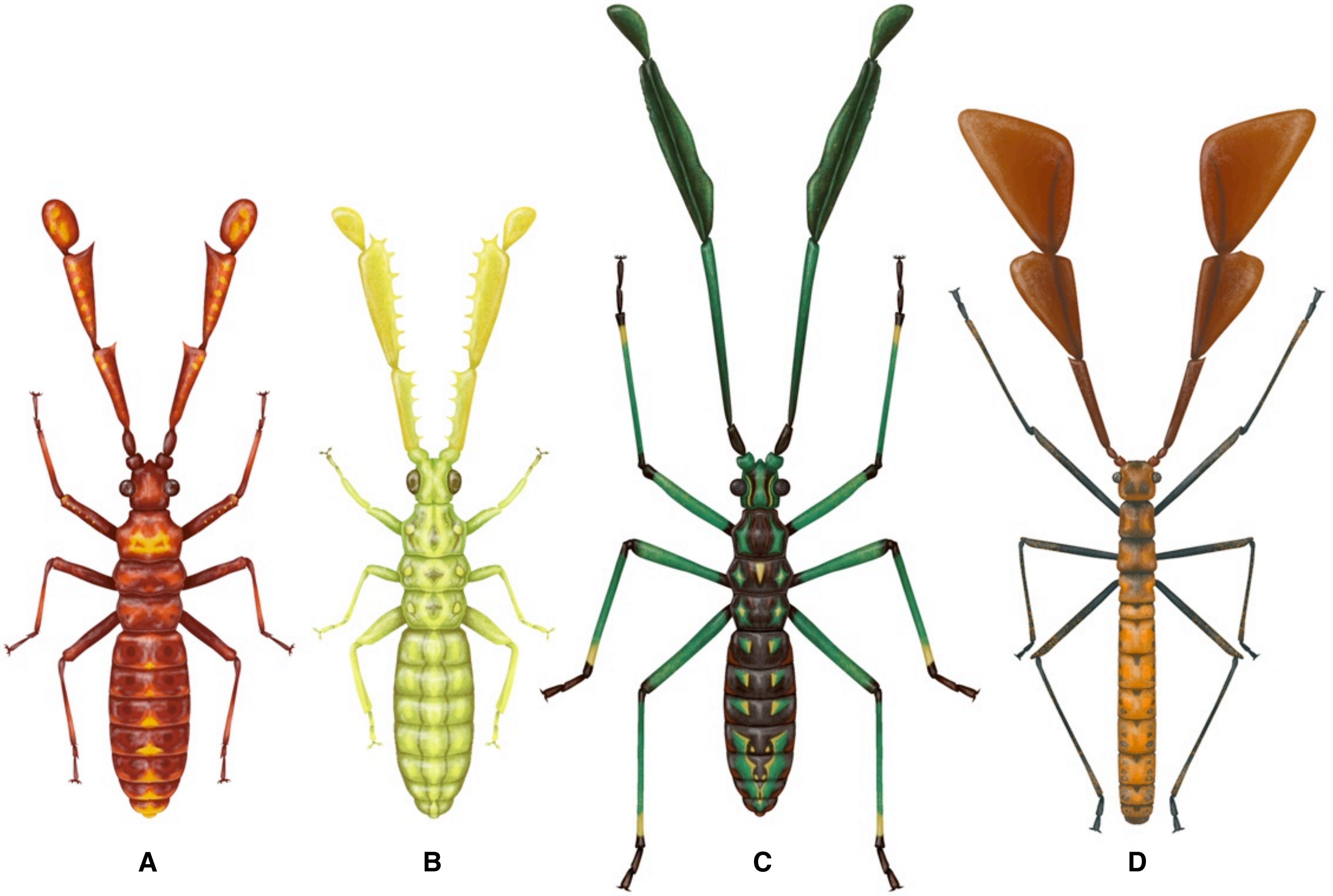

Fig. **1**. Artist recreation of the presently known Cretaceous coreids with elaborate antennae. Illustrations by Liz Sisk (USA). Dorsal habitus, bodies are scaled to the same uniform length to highlight the antennae to body ratios. Colorations are artistic recreations based upon extant coreids rather than the actual specimens, whose colors were not preserved in the amber. **A**. *Ferriantenna excalibur*. **B**. *Ferriantenna sp.* "club-like antennae" [undescribed]. **C**. *Ferriantenna gracenuoxichenae* **sp**. **nov**. **D**. *Magnusantenna wuae.*

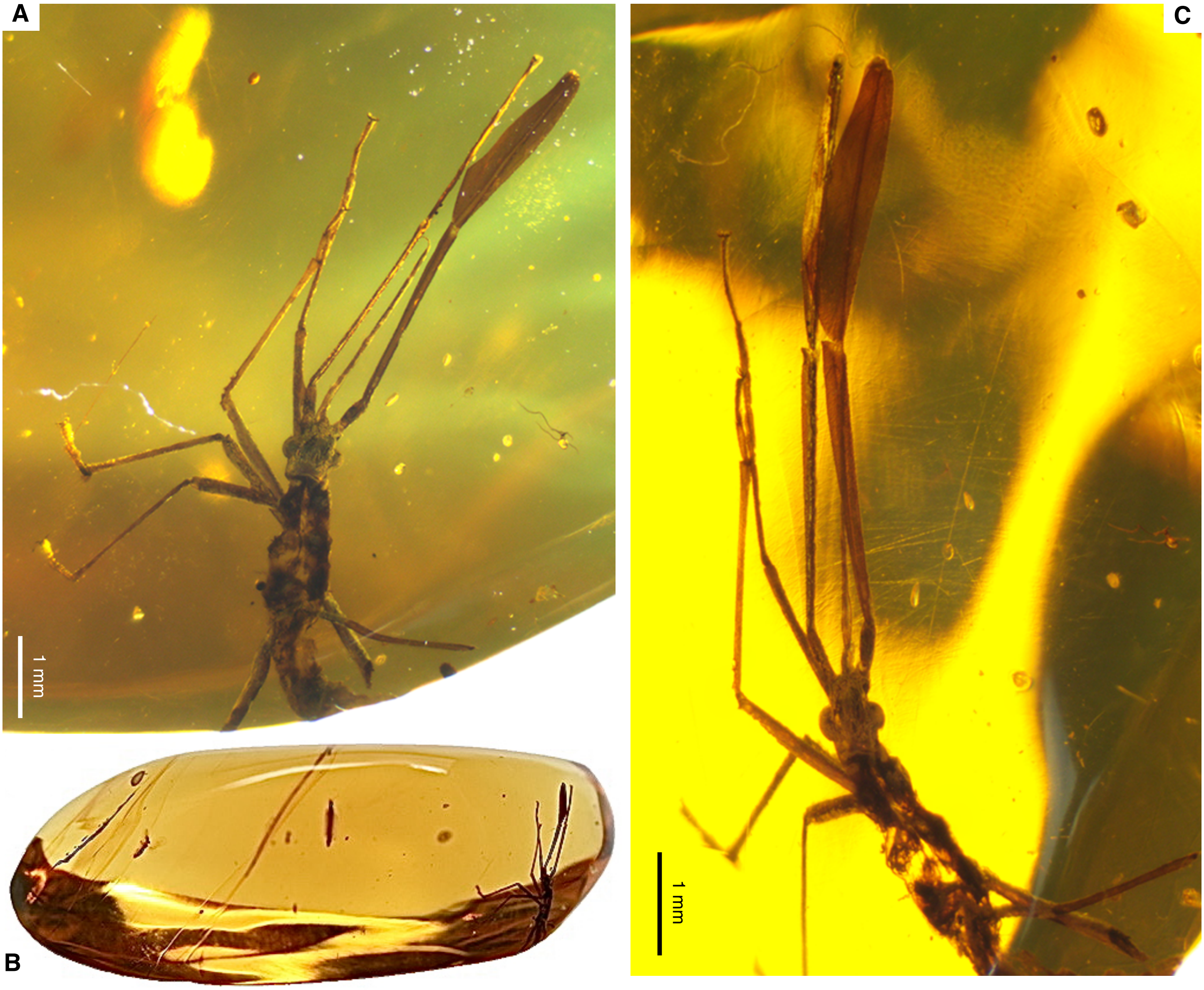

Fig. 2. *Ferriantenna gracenuoxichenae* **sp. nov**. holotype.

A. Dorsolateral habitus. **B**. Amber specimen #GM12170200548 showing the inclusion on the far right. **C**. Dorsolateral view of the habitus.

Ferriantenna gracenuoxichenae sp. nov.

(Fig. 1C, 2, 3)

ZooBank : http://zoobank.org/FDF27C53-E8D2-44B4-B985-CEE2589A2AA0

Holotype. – Amber specimen #SC4626, GM12170200548. Roughly a rounded parallelogram piece of amber, approximately 3.69 cm long, 1.96 cm wide, and 1.42 cm thick, with high clarity and 2 small inclusions (one †Archaeatropidae (Psocodea) and a Nematoceran (Diptera)) in addition to the herein discussed species. The herein discussed species is not obscured and close to the surface (Fig. 1B). Specimen partially complete yet well-preserved, likely fourth instar. Missing the terminal two or three segments of the abdomen, the hind legs are incomplete, and the terminal antennomeres are missing. Deposited in the Montreal Insectarium (IMQC). Unknown sex.

Type locality and horizon. – Kachin State, Myanmar; Upper Cretaceous ~98.79 ± 0.62 million years old (Shi et al. 2012). At present this genus and species is only known from this stratum.

Differentiation. – At present two congenerics are known (one described (Fig. 1A) and the other unnamed (Fig. 1B); both from the same type locality and deposit (Cumming and Le Tirant, 2021)) and these can be differentiated by antennae morphology. Within congeners, antennomeres II and III have a similar morphology, while in *Ferriantenna gracenuoxichenae* **sp. nov**. antennomeres II is relatively simple and antennomeres III has expansions on the dorsal and ventral surfaces (Fig. 3F).

Description. – Mostly complete nymph that appears to be fourth instar (based upon the characters of Schuh and Slater (1995): posterior margins of the hind wing buds not reaching the anterior margin of the first abdominal tergite; ocelli absent; and tarsi two-segmented). Sex unknown due to the instar stage and missing terminalia of the abdomen. The holotype specimen is relatively complete except for the terminal two or three abdominal segments, the hind femora are missing the distal ends and the remainder of the hind legs are missing, and the terminal antennomeres are missing (Fig. 2A). Overall length (including antennae which are missing the terminal antennomere) 10.91 mm (measured to the end of the incomplete abdomen, therefore the actual length of the insect is slightly longer).

Head. – Antennal socket slightly protruding from the front of the head (Fig. 3A), approximately 0.18 long by 0.19 mm wide, with a greatest width slightly wider than the first antennomere. Head roughly rectangular, 0.75 mm long by 0.49 mm wide (without including compound eyes), including compound eyes head is 0.89 mm wide. The head vertex is relatively smooth, no notable textures or structures

(Fig. 3A). Clypeus protruding into a stout point. The labrum is long and thin and ends in a fine point. Labium tetramerous, when fully extended the labium reaches almost to the apex of the second antennomere (Fig. 3A). Labiomeres of various lengths; labiomere I is 0.44 mm long, labiomere II is 1.01 mm long, labiomere III is 1.04 mm long, labiomere IV is 0.50 mm long (Fig. 3A). Apex of labiomere IV tapering to a fine point which hooks slightly ventrally (Fig. 3A). Compound eyes prominent and distinctly protrude from the head capsule, are located in the center and take up ca. one third of the lateral head margins (Fig. 3A).

Antennae. – Antennae likely tetramerous (in the holotype only the proximal three antennomeres are preserved but at least a fourth was present at one point judging by the socket at the apex of antennomere III; Fig. 3C). Based on congeners, there likely was only a fourth segment at the antenna apex, no additional segments, but the morphology is unknown based on the holotype. Overall antennae lengths 6.30 mm (right) and 6.27 mm (left) [both are missing their terminal antennomeres, therefore the actual length would be even longer], notably longer than the damaged holotype body length (4.61 mm). First antennomere tubular and simple, lacking significant features, 0.52 mm long and 0.19 mm wide. Antennomeres II and III laterally flattened. Antennomere II expansions only slightly protruding on both the dorsal and ventral surfaces (ventral slightly more prominently than the dorsal). These expansions are barely present on the proximal end and expand just slightly throughout the length to the distal end of the antennomere. These expansions are very slight, making this antennomere appear long and slender (Fig. 3F). Margins slightly granular, with no detectable setae. Antennomere surfaces are smooth and possibly slightly tomentose (but this shine could be from the preservation). Second antennomere length 2.90 mm and maximum width 0.19 mm. Antennomere III notably different in shape from antennomere II. The ventral expansion of antennomere III has a maximum width of 0.29 mm and is broader than the dorsal expansion which has a maximum width of 0.17 mm. The ventral expansion steadily expands from the proximal margin for ca. the first third, contracts slightly, then runs parallel with the antennomere shaft for the central third of the expansion, then the distal third reduces until the distal end of the antennomere (Fig. 3C). The dorsal expansion of antennomere III slightly increases in width until near the middle of the antennomere, then decreases in width only slightly throughout the remainder of the length until the expansion terminates on the distal margin (Fig. 3C). Margins finely granular, and no observable setae. Surfaces of antennomere III relatively smooth. Antennomere III 2.88 mm long and has a maximum width of 0.45 mm. Fourth antennomere missing in the holotype.

Thorax. – Thorax centrally deteriorated, but the margins are moderately intact. Thorax surfaces and margins are smooth and lack fine projections/ notable textures. Pronotum roughly hexagonal with the posterior slightly wider than the other margins. The lateral margins expand to approximately the mid-length then contract to the posterior. Overall pronotum length 0.76 mm, anterior width 0.50 mm, posterior width 0.57 mm, maximum width 0.80 mm. Mesonotum and metanotum a similar shape as the pronotum. Mesonotum length 0.69 mm and greatest width 0.92 mm. Metanotum length 0.58 mm and greatest width 0.98 mm.

Legs. – All legs of a similar morphology, only slight differences in length and thickness differentiate them (Fig. 3B). The profemora and mesofemora are of uniform widths (ca. 0.23 mm; Fig. 3B) and the metafemora are slightly thicker (maximum width 0.26 mm). All femora simple, tubular, no ornamentation. Protibiae and mesotibiae of uniform widths and are longer than the femoral shafts. Protibiae and mesotibiae simple, tubular, with no ornamentation. Femora tubular, with surfaces that are smooth. Tibiae are approximately half as wide as the femoral widths. Tibiae on the proximal end start out smooth but about halfway through the length short, sparse setae start and become denser throughout the remainder of the tibiae length until there is dense but short setae on the distal ends of the ventral tibiae surface. The dense but short setae continue on under the tarsomeres (Fig. 3D). Tarsi each with two tarsomeres, and the apex of each two distinct tarsal claws, each with a prominent pulvillus. Leg segment lengths: profemora 2.46 mm, mesofemora 2.27 mm, metafemora 1.95 mm (distal ends broken, metafemora incomplete), protibiae 2.29 mm, mesotibae 2.37 mm, metatibiae missing from the holotype.

Abdomen. – Abdomen notably damaged in the holotype. Most of the abdomen has significant deterioration and is curved towards the amber surface where the terminal two or three abdominal segments are missing (Fig. 2A). Greatest width approximately 0.96 mm. Abdomen without detectable external structures, margins appear to be ca. parallel sided with smooth transitions from one segment to the next.

Etymology. – Patronym, named after the third author's daughter, Grace Nuoxi Chen, as a special Christmas gift of 2023 for her.

Conclusion

This additional species of exaggerated antennae coreid adds to our understanding of antennae diversity from the Cretaceous. As with other Coreidae from the Cretaceous, the morphology of the legs are simple while the antennae are complex, which is in opposition to modern coreids which often have complex leg morphology and simple antennae. This additional species of coreid with elaborate antennae not seen in extant species adds credibility to the double-edged sword hypothesis of coreid evolution presented within Du et al. (2021) and expanded upon in Cumming and Le Tirant (2021). Hopefully additional fossils and species of Cretaceous coreids will be uncovered in the future and help to shed light on the reason for and subsequent loss of these elaborate antennae.

Acknowledgements

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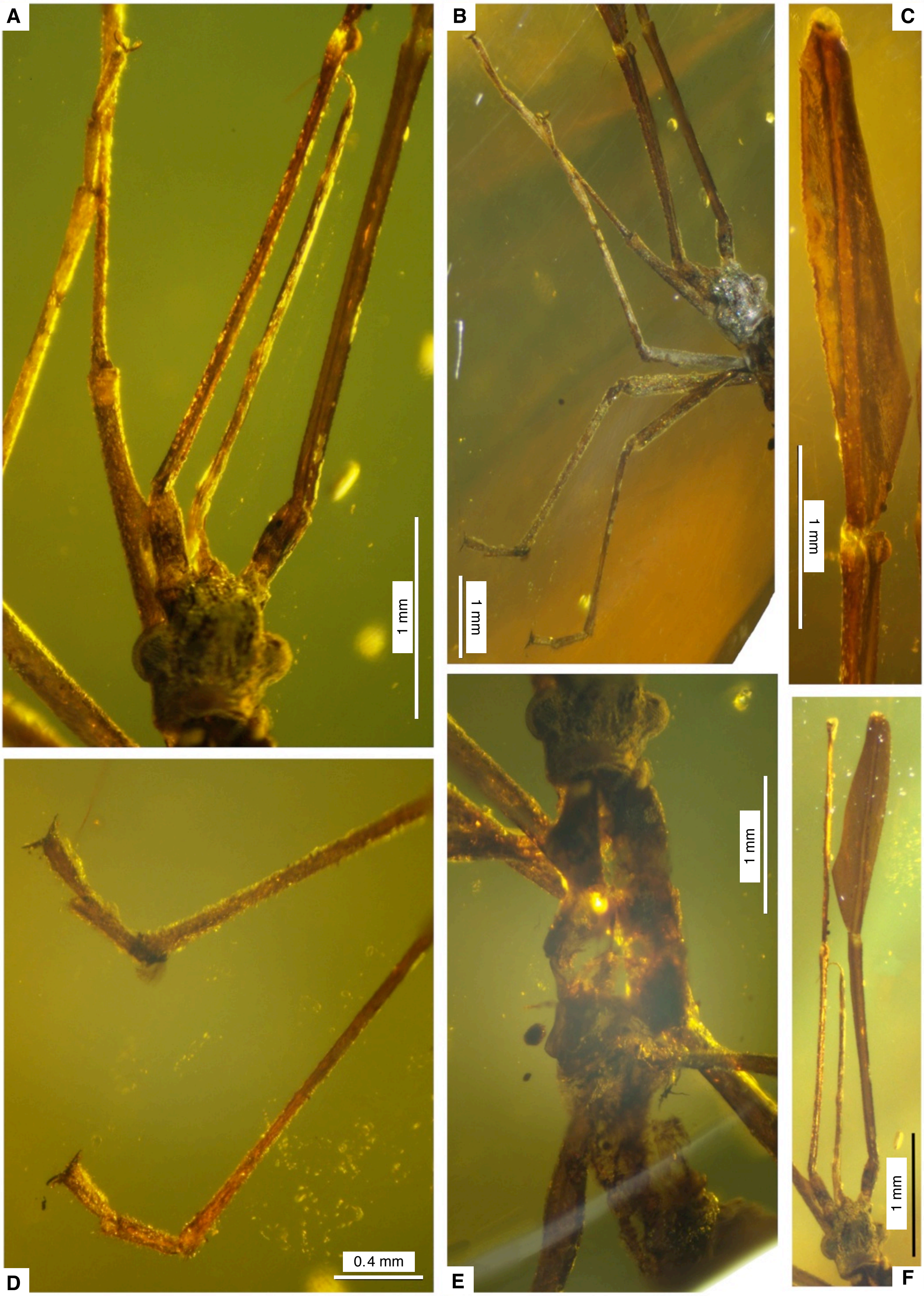

Fig. **3**. *Ferriantenna gracenuoxichenae* **sp**. **nov**. holotype.

A. Head, proximal two antennomeres and extended labium between the antennae. **B**. Legs, dorsolateral. **C**. Details of antennomere III. **D**. Tarsi and distal ends of the tibiae. **E**. Base of head and thorax, dorsal. **F**. Antennae in full view.

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Authors contribution [1]

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Description. – RC
Article proofreading. – RC, LT & HC
Bibliographic work. – LT
Material study. – RC & HC
Author of the figures. – RC

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Résumé

Cumming R.T., Le Tirant S. & Chen H., 2024. – Une espèce additionnelle du genre *Ferriantenna* Cumming & Le Tirant, 2021 du crétacé est décrite avec des antennes surdimensionnées (Hemiptera, Coreidae). *Faunitaxys*, 12(5): 1 – 6.

Une nouvelle espèce de Coreidae à antennes démesurées est décrite de l'ambre du Myanmar du Crétacé supérieur (stade Cénomanien). *Ferriantenna gracenuoxichenae* **sp**. **nov**. peut être différenciée de ses congénères actuellement connues par des antennes nettement plus longues que le corps (à peu près de la même longueur chez les autres espèces) et par la morphologie des antennomères II et III significativement différente (de forme et de taille similaires chez les autres espèces). L'espèce décrite ici, comme les congénères du même gisement, est malheureusement une nymphe sans abdomen. Par conséquent, elle ne permet pas de produire des caractères morphologiques supplémentaires permettant un placement plus sûr au sein des coréides.

Mots-clés. – Hemiptera, Coreidae, *Ferriantenna*, paléoentomologie, taxonomie, description, nouvelle espèce, Myanmar, ambre.

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Illustration de la couverture :

Ferriantenna gracenuoxichenae **sp**. **nov**. holotype.

Crédits:

@ **Liz Sisk** (USA) : Fig. 1.
@ **Royce T**. **Cumming** (USA) : Fig. 2 & 3.

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